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NOTES ON THE DISTRIBUTION OF THE CHIPMUNKS
(*EUTAMIAS*) IN SOUTHERN BRITISH COLUMBIA
AND THE ROCKY MOUNTAIN REGION OF SOUTHERN
ALBERTA WITH DESCRIPTIONS OF TWO NEW
RACES

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A critical examination of the specimens of chipmunks in the collection of the Museum of Zoology at the University of British Columbia, and the B. C. Provincial Museum, makes it evident that the existing concepts of the distribution of certain species and races of *Eutamias* in southern British Columbia and western Alberta require revision.

In the course of the present study many specimens have been loaned to me from the National Museum of Canada through the kindness of Dr. R. M. Anderson; others have been borrowed from the U. S. Fish and Wildlife Service collection, through Dr. H. H. T. Jackson; from the Kenneth Racey collection, Vancouver; and from E. S. Booth of Walla Walla, Washington. Grateful acknowledgment is made of this assistance.

The genus *Eutamias* is represented in western Canada by four species: *Eutamias amoenus*, *Eutamias minimus*, *Eutamias ruficaudus*, and *Eutamias townsendii*. Certain phases of the distribution of the first three of these have been studied in connection with this paper.

Eutamias townsendii (Bachman) is represented by two races in extreme southwestern British Columbia, a region not dealt with in the present study. *Eutamias amoenus felix* (Rhoads) occupies a slightly wider range in the same general region, while *Eutamias minimus caniceps* (Osgood) occurs in extreme northwestern British Columbia. Both races occupy ranges outside the region dealt with in this paper.

Eutamias amoenus:—The species *Eutamias amoenus* ranges over practically the entire southern half of British Columbia from the Rocky Mountains to the beaches of the Pacific Coast and north to the region between the 54th and 55th parallels of north latitude. It occurs also in parts of the Rocky Mountains of western Alberta but its distribution there makes it plain that the species had its origin west of the Rockies and has pene-

trated onto the east slope to a very limited degree by way of the low passes. As will be discussed further later in this paper the two geographic races inhabiting the Rocky Mountains of Alberta do not occupy contiguous territory but are separated by 100 miles or more of mountains in which no chipmunks of the *amoenus* group are known to occur.

Eutamias amoenus luteiventris (Allen)

This race occupies a very wide range in southeastern and south-central British Columbia and southwestern Alberta. Over much of this region it is the only chipmunk present but at various places it occupies the same general terrain as one or more other species of chipmunks. Where this occurs there is frequently an ecological separation that for the most part prevents interspecific competition.

In the Waterton Lakes region of southwestern Alberta this race is in co-occupancy with *Eutamias ruficaudus* and *Eutamias minimus oreocetes* and here the ecological separation is most apparent. *Luteiventris* inhabits the aspen parkland type of environment to the exclusion of the other two species. It is thus the only chipmunk seen at lake level at 4,000 feet elevation. Where, as on the east slope of Sofa Mountain, there is continuous parkland environment from the prairie edge to timberline *luteiventris* is found up to timberline and in close proximity to *minimus*.

Farther north on the east slope of the Rockies, at the level of Banff, Alberta, *luteiventris* is more local in its distribution. It is found in fair numbers at the base of Mt. Rundle, along the lower reaches of Brewster Creek and Redearth Creek, and on Mt. Inglesmaldie, all but the last, localities on the south side of the Bow Valley and at elevations between 4,500 and 5,000 feet. It has not been seen at or near timberline, nor anywhere north of the Bow Valley, though it seems probable that it does occur at lower levels along the lower reaches of some of the streams tributary to the Bow from the north.

None was seen on the Panther, Red Deer, Clearwater or Saskatchewan rivers in the northern part of Banff Park. The race is, however, widely distributed on the western slope of the Rockies. In Kootenay and Yoho Parks, B.C., it was the only chipmunk taken, but *minimus* certainly occurs at and near timberline where these two parks have a common boundary with Banff Park, as the latter species has been seen and taken just on the Alberta side of the Interprovincial Boundary. It was found abundantly at Mt. Assiniboine on the British Columbia side of the Rockies just south of Kootenay Park (Crowe, 1943: 399).

The northernmost locality record for *luteiventris* on the west slope of the Rockies is Kinbasket Lake, B. C.

From this Rocky Mountain area of distribution the race extends westward through the mountains of southern British Columbia to the North Thompson River near Kamloops and to the Monashee Range on the east side of the Okanagan Valley. In the latter region intergradation with *Eutamias amoenus affinis* takes place.

Material from southern British Columbia is inadequate to give a clear

picture of the nature of the distribution of *luteiventris* and of *affinis* where these two meet. In certain places there is an indication of altitudinal separation with *luteiventris* occupying the higher zones and *affinis* the valley bottoms. In other places all levels seem to be occupied by a population of intergrades.

In a few localities large rivers seem to serve as barriers to chipmunk distribution. In the vicinity of Kamloops the South Thompson River, flowing in an east-west direction, is joined from the north by the North Thompson River. In the northeast angle of this junction the chipmunk population is intermediate between *affinis* and *luteiventris* but closer to the latter, while west of the North Thompson and south of the South Thompson the chipmunks are typical of *affinis*.

At Newgate, B.C. the Kootenay River appears to have some barrier effect. Here in 1930 there was a readily discernible difference in the populations on either side of the river. Chipmunks collected on the east side are referable to *luteiventris* and differ most obviously from those across the river in having buff bellies, upper sides of the feet ochraceous and the tail edged with buff, as compared with the white bellies, pale yellowish feet and white-margined tails of the chipmunks from the west side of the river. This west-side population is apparently intermediate between *luteiventris* and *canicaudus*. The results of such intermediacy are closely similar to the characters of *affinis*, and Cranbrook specimens, which appear to me to fall into the same category, were so identified by Howell (1929:73). However the tails of these intermediates are even paler ventrally and more obviously margined with white than the mean of *affinis*. *Canicaudus* is a larger, longer-tailed race than *luteiventris* but the Newgate specimens are not intermediate as regards dimensions. In this respect they are not significantly different from the condition in the smaller race.

At Newgate there were no discernible differences in the environments offered by the opposing sides of the river.

At another point in southwestern British Columbia a river apparently separates chipmunk populations. Dr. R. M. Anderson writes me that a National Museum of Canada field party collecting on the west side of the Kootenay River took *E. amoenus luteiventris* and *E. ruficaudus simulans*, while Maillard (1932:289) took only *E. a. affinis* (cited by him as *E. r. simulans*) (Anderson 1934) on the east side of the river.

Specimens of *luteiventris* examined 53: Alberta: Waterton Lake 6, Brewster Creek 5, Healy Creek 6, Mount Inglesmaldie 1, Mount Rundle 2, 15 miles up Spray River 1, Marvel Lake 1. British Columbia: Vermilion Crossing 1; Kootenay Crossing 1, Radium Hot Springs 1, Sherbrooke Lake near Field 2, Crow's Nest Pass 2, 19 miles w. of Invermere 1, Kinbasket Lake 1, Newgate 5, Phoenix 1, Revelstoke 10, Monashee Pass 4, Rayleigh 2.

Specimens of *affinis* examined, 47 all from British Columbia: Midway 1, Anarchist Mountain 10, Hedley 6, Ashnola Creek 4, Fairview-Keremeos summit 4, Salmon Arm 2, Kamloops 10, Black Pines 2, Wentworth Lake 2, Princeton 1, Clinton 1, Lytton 2, Pavilion 2.

Eutamias amoenus ludibundus (Hollister)

As mentioned earlier, there exists, between the northernmost known locality of *luteiventris* on the Alberta side of the Rocky Mountains and the southernmost locality inhabited by *ludibundus* in that province, a hundred-mile stretch of terrain in which *amoenus* chipmunks are not known to occur. Many chipmunks have been examined closely in the field in this region and some collected, but all have been *minimus*.

The Jasper population of *ludibundus* is at the eastern end of Yellowhead Pass; the Bow Valley *luteiventris* at the eastern entrance to Kickinghorse Pass. There are no low passes between the two.

E. a. ludibundus in the Athabasca valley near Jasper, Alberta, inhabits rockslides and rock cliffs close to the valley floor (3,500 ft.) and altitudinally above the main range of *minimus* at that latitude. Both, however, have been taken in the same rockslides on a few occasions. *Ludibundus* ranges to timberline but does so rarely in the Jasper region.

In the heavily wooded mountainous terrain, extending from the west slope of the Rockies in the vicinity of Robson to the valley of the Fraser River near Quesnel and south through the eastern Cariboo district to Canim Lake, *ludibundus* is the only chipmunk.

Specimens of *ludibundus* examined, 59: Alberta: Jasper and vicinity (Astoria Creek and Portal Creek) 19, Tonquin Valley 1. British Columbia: Moose Lake 5, Indianpoint Lake near Barkerville 8, Quesnel 1, Canim Lake 3, Lac La Hache 5, and Horse Lake 17.

The great plateau area constituting the western Cariboo and Chilcotin districts, together with the western mountain ranges, is apparently inhabited by a clearly differential race of *Eutamias amoenus* for which there is no name available. This newly recognized geographic race is named and described below.

Eutamias amoenus septentrionalis subsp. nov.

Type: Female adult, number 1648 British Columbia Provincial Museum, taken July 24, 1938 at Ootsa Lake P.O., on the north shore of Ootsa Lake, B.C., by I. McT. Cowan. Original number 839.

Distribution: West-central British Columbia west of the Fraser River, north at least to Babine Lake, south at least to Chezacut Lake and west to the sea coast at the heads of certain inlets.

Diagnosis: A large bodied, relatively short-tailed race of *Eutamias amoenus*.

In summer pelage all dark stripes black, with a reddish brown wash over their anterior ends to a slight degree on the middle stripe, and a progressively greater degree on the lateral stripes; inner light stripes reddish brown anteriorly, paler on lower back; outer light stripes white with faint reddish brown wash; sides between Cinnamon and Tawny (capitalized color terms are from Ridgway "Color Standards and Nomenclature"); a wash of the same color over shoulders and part way down back as mentioned above; rump between Drab and Grayish Olive; under side of tail between Pinkish Cinnamon and Cinnamon Buff; underparts white.

In worn winter pelage all dark stripes broad and black without tipping; inner light stripes brownish gray, outer white; rump between Light Grayish Olive and Drab; under side of tail between Pinkish Buff and Cinnamon Buff; sides of body pale, nearest Cinnamon Buff.

Comparisons: Most nearly like *E.a. affinis*, from which it differs as follows: In worn winter pelage darker throughout with all 5 stripes black instead of outermost stripes with pronounced brownish wash. Inner light stripes brownish gray, rather than clear gray. Rump brownish rather than grayish; shoulders and flanks more brightly coloured.

Mid-summer juvenals of *septentrionalis* as compared with those of *affinis* are duller in general body color with a dull brownish wash across the shoulders, darker median light stripes, darker sides and with color of sides extending farther onto thighs; rump with an ochraceous tinge rather than clear gray.

From *ludibundus*, the only other race with contiguous range, *septentrionalis* is readily separable on the basis of color of undersurface of tail. This is usually rich tawny in *ludibundus*, almost as it is in *ruficaudus*, while in *septentrionalis* it is paler, as described above. In winter pelage *septentrionalis* differs from *ludibundus* in having the dark stripes broader and darker, the sides paler, and the upper surface and rump more grayish. *Septentrionalis* also differs from *ludibundus* in having a longer body while tail length remains the same. Mean and extreme measurements in a series of 18 specimens, 9 ♂♂ and 9 ♀♀, from Jasper Park, Alberta, are: body length 117 ± 1.30 , (109-127); tail 95 ± 1.90 , (86-104); while corresponding measurements for 15 *septentrionalis*, 10 ♂♂ and 5 ♀♀, are: 123 ± 1.20 , (114-130); tail 95 ± 1.84 , (89-100). The difference in body length has been subjected to statistical test for probability and has a value of $P =$ less than .01 and can therefore be regarded as significant.

Skull: Not differing in general dimensions from those of *affinis* and *ludibundus* but usually separable from the latter on the basis of dorsal outline of cranium. In *ludibundus* the anterior part of the cranium is swollen to produce, between the supra-orbital processes, a prominent bulge on the dorsal outline, or an angle on the even contour of this line. In *septentrionalis* the high point on the dorsal surface is farther back, at the fronto-parietal suture. The condition in *affinis* is approximately intermediate.

Specimens examined 31: Ootsa Lake 6, Western end of Eutsuk Lake, 1; Chezacut Lake, 10; Itcha Mountains, 1; Babine Lake, 1; Puntchesakut Lake, 3; Nulki Lake, 6; Rocher Deboule, 1; and Lonesome Lake, 2. The National Museum of Canada specimens from Kimsquit, Stue, Caribou Mts., and Rainbow Mts. were examined in February, 1944, and identified as belonging to the race here described but were not re-examined during the preparation of the description of this race.

Remarks: Specimens now referred to this race have been examined by other students of mammalian systematics and identified variously. For instance Howell examined the Chezacut specimens and their labels bear his determination of them as *affinis*. Later Anderson and Rand reported upon the Kimsquit and other specimens from the coastal

region (op. cit.) and while noting the paler ventral surface of the tail, regarded them as representing the race *ludibundus*. Further study has revealed other characters serving to identify this population of *amoenus* chipmunks from the great central plateau region of British Columbia and from the western mountains as distinct from the other described forms. No specimens have been seen from the area in which *septentrionalis* would be expected to intergrade with *ludibundus* but it seems certain that intergradation does take place. The Chezacut specimens show a slight approach toward *affinis*, particularly in the restriction of the reddish dorsal wash on the shoulders and dorsum so characteristic of *septentrionalis*.

Eutamias minimus.—*Eutamias minimus* is known to inhabit the greater part of British Columbia north of the 55th parallel of latitude as well as the length of the Rocky Mountain Range of Alberta south to the International Boundary. *Eutamias minimus caniceps* (Osgood) is the race occupying the extreme northwesterly part of British Columbia east of the Coast Range and south as far as Telegraph Creek. *Eutamias minimus oreocetes* Howell is found at high altitudes in the extreme southern end of the Canadian Rockies. As yet no specimens have been taken in British Columbia in the Waterton Lakes Park area but the author has seen chipmunks of this species within two miles of the Alberta-B.C. boundary and there is no ecological barrier to prevent them ranging across. This they undoubtedly do. The intervening area, between the ranges of the two races mentioned above, is inhabited by *E. m. borealis* Allen.

There is a noteworthy change in the ecological distribution of the *minimus* chipmunks in the Rocky Mountains between the 49th and 54th parallels of latitude. In the Waterton Lakes area of southwestern Alberta *oreocetes* is a very scarce mammal and is confined exclusively to the most intensely insolated mountain slopes above timberline where fairly coarse broken rock is strewn on slopes that support sparse stands of weeds and grasses.

At the latitude of Banff, Alberta (approx. 51°) *E. minimus* is distributed from alplands to valley floor—that is, at elevations from 7,800 ft. to 4,500 ft. Preference, however, seems to be for the partially wooded or brush-covered areas, and for burns in early stages of forest regeneration at intermediate elevations.

In the vicinity of Jasper, Alberta, (latitude 53°) *Eutamias minimus* is an inhabitant of the lower elevations in the more easterly areas of the Rockies. It extends west to Jasper but not beyond, and it is not found at timberline on the mountains of the main divide at least.

In the Peace River district of British Columbia at latitude 56° it was found to be an inhabitant of the aspen parkland floral type at an altitude of 1,500 feet.

Comparisons of series of specimens from various points on the latitudinal distribution of *E. m. borealis* reveals that there is a cline in total length and tail length measurements (table I) with the more northerly populations having greater body size and longer tail than the southern populations. For this reason external measurements do

not serve as reliable criteria for delimiting the ranges of *borealis* and *oreocetes* in the area where these two races meet.

Specimens examined from the Rocky Mountain region as far south as the Bow Valley at Banff have the color characteristics of *borealis*. This was mentioned by Anderson and Rand (op. cit.) who found themselves in disagreement with Crowe's (op. cit.) assignment of Banff specimens to *oreocetes*. I have not seen Crowe's series, which was preponderantly from the timberline region and it may be that the timberline populations from the ranges south of the Bow Valley have the color characteristics of *oreocetes*, but the change would be an unexpectedly abrupt one if this were the case.

In 1944 Carl and Hardy (1945: c 33) discovered *Eutamias minimus* in the Selkirk Mountain range 19 miles west of Invermere. Here the species was occupying a timberline habitat and was not found below such elevations. Fairly intensive studies of the mammals of the Selkirk Range in the vicinity of Revelstoke (Cowan and Munro 1945) and of Glacier (Munro mss.) failed to discover this chipmunk there. It can be assumed then that the population of the southeastern Selkirks is an isolated one, separated from the timberline populations of the Rockies by the full width of the Rocky Mountain trench and without more northern connection with the main range of the species.

The original collections made by Carl included but two specimens of *E. minimus* both juveniles, but in August 1945 the author took three additional specimens, an adult pair and a juvenile. These five specimens reveal that the Selkirk population possesses characteristics distinguishing it from both *borealis* and *oreocetes* and it is here named and described as—

Eutamias minimus selkirki ssp. nov.

Type: Adult female, skin and skull, Museum of Zoology, University of British Columbia number 1551, taken August 28, 1945, at Paradise Mine near Toby Creek, 19 miles west of Invermere, B. C. by I. McT. Cowan.

Diagnosis: A small pale race of *minimus* resembling *oreocetes* in external dimensions and in size and proportions of skull. In August pelage median dark stripe black; second dark stripes brown on anterior half black on posterior half; outer dark stripes brown. Inner light stripes heavily overlaid with gray and brown; outer light stripes white washed with gray on rump. Dark facial stripes extending to nostrils. Ear black anteriorly, white posteriorly; post-auricular patch grayish white. Crown hair Brown (capitalized color terms are from Ridgway, "Color Standards and Nomenclature"); sides nearest Cinnamon Buff; rump between Mouse Gray and Deep Mouse Gray; under-surface of tail between Pinkish Cinnamon and Cinnamon Buff; tail edged with Pinkish Buff; upper surface of front feet whitish, of hind feet gray.

Comparisons: *E. m. selkirki* is most like *E.M. oreocetes* but differs from that race in darker body color; rump and hind legs in August specimens gray rather than grayish with a yellowish brown wash; dorsal surface of shoulders and back with duller brown hair-tipping; dorsal

surface of tail darker in comparable specimens; facial stripes darker and more extensive; crown darker and more grayish rather than brownish in tone.

Measurements: Measurements of the adult male and female are respectively: total length 189 mm., 204 mm.; tail 85, 91; hind foot 32, 34; greatest length of cranium 31.6, 31.7; basilar length of Hensel 23.8, 24.2; zygomatic width 17.4, 18.2; least interorbital width 7.7, 7.7; width of brain case 15.7, 15.8; length of upper molar row 5.3, 5.5; length of nasals 9.0, 9.5.

Distribution: Known only from the vicinity of the type locality.

Remarks: *E. m. selkirki* in the sum of its characteristics approaches closer to *oreocetes* than it does to *borealis*. From the latter race it differs in having a shorter tail; upper surfaces of feet whitish, rather than distinctly brownish; median dark stripe narrower; and general body color brighter and less brownish.

Specimens examined: 5, all from the type locality.

Eutamias ruficaudus:—This species is represented in the region under discussion by the races *E. r. simulans* Howell, recorded from Nelson by Anderson and Rand (1943) and from Invermere, B.C. by Crowe (1943) and *E. r. ruficaudus* Howell. The latter race is a fairly abundant inhabitant of the upper rim of the spruce forests in the vicinity of Waterton Lakes Park, Alberta, and Akamina Pass, B.C. Anderson and Rand (1943:135) record a specimen from Portal Creek, Jasper Park, Alta., as referable to this race, thus extending the known range of the race north from 49°50' to 53° north latitude. No other specimens of *ruficaudus* have been taken in the region between Waterton Lake and Jasper despite a considerable amount of careful biological work extending over many years.

Dr. Anderson has very kindly loaned me the specimen in question, male, number 16033, National Museum of Canada. In body color it resembles summer specimens of *ruficaudus* closely, but in summation of characters is clearly referable to *Eutamias amoenus ludibundus*. The brilliant under-tail color of this race closely resembles that of *ruficaudus* and in the specimen in question is perfectly matched by certain topotypes of *ludibundus* collected by Hollister (1911) and used as a basis for the original description of this race. The external measurements 211, 92, 31, while considerably less than the minimum measurements of topotypical *ruficaudus* given by Howell (1929:96) are within the limits of variation for that species as it occurs in Waterton Lakes Park except as regards length of hind foot. All *ruficaudus* measurements available indicate a hind foot in excess of 32 mm. long, and averaging in excess of 34 mm. As regards cranial dimensions the Jasper specimen is below the minimum for *ruficaudus* in almost every respect and below the mean of *ludibundus* in all measured features. (See table II.)

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TABLE I
External measurements of *Eutamias minimus* populations from northern British Columbia to northern Montana.

	N.	—Total Length—		—Tail—		—Hind Foot—	
		Mean	Extremes	Mean	Extremes	Mean	Extremes
Peace River, B.C.	7	217	209-227	100	93-108	32.5	31-34
Jasper, Alta.	9	210	198-218	95	90-100	32	30-33.5
Banff, Alta.	17	198	193-211	88	81-94	32	29-34
Waterton-Glacier	4	195	185-201	85	82-90	32	31-34

TABLE II
Comparison of cranial measurements of *E. r. ruficaudus* and *E. a. ludibundus*.

	N	Greatest Length	Zygomatic Width	Cranial Width	Interorbital Width	Length of Nasals
<i>Eutamias r. ruficaudus</i> *	20	35.2(34.0-36.2)	19.5(19.0-20.3)	15.3(14.5-15.8)	8.0(7.5-8.8)	11.2(9.6-11.9)
<i>Eutamias a. ludibundus</i>	12	33.9(33-34.4)	19.0(18.4-19.5)	15.0(14.3-15.6)	7.6(7.4-7.8)	10.9(10.1-11.4)
N.M.C. spec. No. 16033		33.9	18.6	14.7	7.3	10.7

*In part from Howell, 1929.

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